Diane Nielson

UTAH GEOLOGICAL ASSOCIATION
NEWSLETTER

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This helps predict NaCl deposition vis á vis the problem at Wanderer.
Lemmon

PROGRAMS

THURSDAY, April 13, 1989

THE UGA AND THE UNIVERSITY OF UTAH ARE CO-SPONSORING AN ** AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS DISTINGUISHED LECTURE **

JAMES R. STEIDTMANN, PROFESSOR, DEPT. OF GEOLOGY & GEOPHYSICS, UNIVERSITY OF WYOMING

LARAMIDE BASIN SUBSIDENCE AND BASEMENT UPLIFT IN ROCKY MOUNTAIN FORELAND OF WYOMING

The basement-cored ranges of the Rocky Mountain foreland have attracted geologists' attention since the time of early exploration of the western United States and have been the subject of numerous structural studies since early in this century. Until the advent of hydrocarbon exploration, however, the basins got little attention. Even today, our knowledge of the uplifts far exceeds that concerning basin genesis. The most recent work shows that uplift of the ranges and subsidence of the basins are intimately related and suggests that viewing the subsidence-uplift couple as

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MONDAY, April 24, 1989

CHRISTOPHER J. DUFFY, UTAH WATER RESEARCH LABORATORY, UTAH STATE UNIVERSITY

HYDROGEOLOGY OF THE GREAT BASIN: ROLE OF SELF-SIMILAR TOPOGRAPHY & CLIMATE INDUCED BRINE CONVECTION

The Great Basin of the western U.S. is characterized as a hydrologically closed region, with no outlet except to the atmosphere. Individual closed basins exhibit distinctive topography with flat playas or shallow lakes enclosed by steep mountain ranges. Annual precipitation, temperature, and evaporation are strongly correlated with elevation of the surrounding range. As a result of closure, this arid environment shows a sensitive dependence to changes in hydro-climatic conditions (e.g. Mono Lake, Great Salt Lake). Our research has examined scaling relationships for the topography and climate of closed basins. The work indicates mountain slopes are self-similar; and by correlation, mean climate variables are also found to be

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The AAPG Distinguished Lecture will be held **Thursday**, April 13 at the Salt Aire Room in the Union Building on the University of Utah campus. Lunch will be served at 12:00 and will cost the same as a regular UGA luncheon. Please call in your reservations by Tuesday, April 11, 12:00 noon.

The Monday April 24th lecture will be held at the Chuck-A-Rama Restaurant, 2960 Highland Drive. Lunch is served at 12:00 noon and the talk begins at approximately 12:30 -12:45 p.m. Please call in your reservations by Monday at 10:00.

RESERVATIONS Carole Pearce, USGS-Water Resources Division **524-5663**

Reservations $7.00; without reservations $8.00; students $5.00

LARAMIDE BASIN SUBSIDENCE (con't)

the "unit of deformation" in the foreland is most likely to lead to a better understanding of the timing and kinematics of the Laramide orogeny.

The Wind River Range in western Wyoming is an excellent natural laboratory for studying a Laramide uplift. A COCORP seismic profile provides geometric control and tectogenic sediments record the history of uplift and erosion. The stratigraphy and provenance of these sediments indicate a complex Laramide and later tectonic history for the range and identify the timing and position of individual faulting events. These events are (1) main uplift of the range by motion on the Wind River fault and the formation of an erosion surface of low relief (Late Cretaceous through early Eocene), (2) elevation of this erosion surface as much as 3,000 feet by motion on imbricates and associated tear faults in the hanging wall of the Wind River fault (end of early Eocene), (3) collapse of the tip of the Wind River fault into sedimentary fill of the Green River basin (between middle Eocene and late Oligocene), (4) uplift of the crest of the range by nearly 3,000 feet forming the highest peaks in the Wyoming foreland (late Oligocene), and (5) collapse of the southern part of the range along normal faults (Neogene).

Basin modeling in two distinctly different structural settings points to several driving mechanisms of subsidence in Laramide basins. Subsidence of the northern Green River basin was a flexural response to sediment loading and the intracrustal and topographic loads imposed by uplift of the adjacent Wind River Range. In contrast, the Hanna basin subsided when a rigid crustal block rotated downward as the Rawlins uplift was raised on the other end. Both flexure and rigid block rotation likely are operative to varying degrees in most Laramide basins.

A schematic cross section through central Wyoming suggests that deep basins, where both rotation and tectonic loading are important, support structurally low ranges. Where rotation is not an important component of subsidence, basins support structurally high ranges. basement uplift are genetically linked, both indicate the timing of Laramide deformation.

HYDROGEOLOGY OF THE GREAT BASIN (con't)

self-similar with respect to elevation. On the playa or closed lake portion of the basin, high evaporation rates produce a concentrated brine, leading to large vertical and horizontal density gradients in underlying groundwater. Numerical modeling experiments demonstrate the existence of a free convection cell and recirculation of solutes beneath the playa and toward the margin of the playa. It is shown that the motion of the salt nose which develops is the result of a balance between climate activity recharging the uplands, and negative buoyancy induced by evaporating brine on the playa-closed lake. A Rayleigh number is defined which relates the state of hydrogeochemical cycling to the magnitude of climatic forcing. Implications for paleoclimate research and the evolution of basin brines will be discussed.

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Please send material to be printed in the UGA Newsletter by the 1st day of the preceding month to Christine Wilkerson, UGA Newsletter Editor, c/o UGMS, 606 Black Hawk Way, Salt Lake City, UT 84108.